LongView ASSOCIATES

MEMORANDUM

Date: **August 25, 2003**

To: **Dean Grover, U.S. Forest Service Region 6**

From: **Steve Padula, Long View Associates (LVA); Emily Andersen, LVA**

Subject: **Sediment Transport Mitigation**

LVA has completed its research on sediment transport mitigation measures required as part of a FERC license and/or settlement agreement relating to a relicensing process (see attached summary table). Our research was based on a review of hydropower projects 50+ MW in size that have been granted or are awaiting the issuance of a new license by FERC since 1994. In addition to reviewing the issued license, we reviewed the FERC-issued NEPA document and settlement agreement (where applicable) to complete this exercise.

Pursuant to the USFS scope of work, the attached summary table includes the following information:

- Location of project (river and state), size of project (MW) and length of license term and the date license was issued.
- Description of mitigation measure (i.e., type and amount of material, duration, timing, repetition).
- Type of sediment (fines, gravel, etc.) being mitigated for.
- Whether the mitigation is to take place within or outside the project boundary.
- Estimate cost of the mitigation measure.
- Description of monitoring requirement (if any).

In summary, of the 35 projects[1] in our database, we identified 9 for which licenses and/or settlement agreement include conditions to mitigate for the interruption of sediment being transported downstream of the projects. In general, the mitigation measures involved the development of a gravel augmentation study or program (8 of 9), were being required to replace the loss of appropriately-sized spawning gravels (8 of 9), were to be implemented within the project boundary (7 of 9), and involved some form of a monitoring program (8 of 9).

[1] Twenty-six (26) projects have been issued licenses and nine (9) projects are awaiting issuance of a new license.

Please let us know if you have any questions or need additional information. Thank you.

Enclosures

SEDIMENT TRANSPORT MITIGATION MEASURES AS CONDITIONS OF A FERC LICENSE AND/OR SETTLEMENT AGREEMENT - REVIEW OF 50+ MW PROJECTS RELICENSED[1] SINCE 1994 (ORGANIZED FROM NEWEST TO OLDEST LICENSES)

Project	Location (river and state)	Size (MW)	Description of sediment transport mitigation measure(s)	Type of sediment loss	Within/outside project boundary	Estimated cost ($1,000)	Monitoring requirement
1. Pit No. 1 (2687) 1 development *40-yr license issued 03/19/03*	Fall and Pit rivers, CA	69.3	NONE	--	--	--	--
2. Chippewa River: Holcombe (1982), Wissota (2567), Dells (2670) 3 projects; 3 developments *31-yr license(s) issued 12/31/02*	Chippewa River, WI	78.5	NONE	--	--	--	--
3. Carpenter-Remmel (271) 2 developments *50-yr license issued 12/30/02*	Ouachita River, AR	65.3	NONE	--	--	--	--
4. Upper Hudson River: Stewarts Bridge (2047), West (2318), Hudson River (2482), Feeder (2554) 4 projects; 5 developments *40-yr license(s) issued 09/25/02*	Sacandaga and Hudson rivers, NY	135.6	NONE	--	--	--	--
5. Fifteen Mile (2077) 3 developments *40-yr license issued 04/08/02*	Connecticut River, NH/VT	291.4	NONE	--	--	--	--
6. Cowlitz River (2016) 2 developments *5-yr license issued 03/13/02*	Cowlitz River, WA	462.0	Development of a gravel augmentation plan (see Notes)	Spawning gravel	Outside (below most downstream facility -- Barrier Dam)	Capital: $10.3 Annual: $20 Annualized: $20.8	Yes (see Notes)
Notes: The gravel augmentation plan is to include: (1) a plan to monitor the effectiveness of the program, and (2) a plan for discontinuing gravel augmentation if Barrier Dam is breached, including measures to monitor the post-breach adequacy of gravel supplies between Mayfield Dam and Toutle River.							
7. Raquette River: Carry Falls (2060), Upper (2084), Middle (2320), Lower (2330) 4 projects; 14 developments *32-yr license(s) issued 02/13/02*	Raquette River, NY	161.5	NONE				

Project	Location (river and state)	Size (MW)	Description of sediment transport mitigation measure(s)	Type of sediment loss	Within/outside project boundary	Estimated cost ($1,000)	Monitoring requirement
8. Rock Creek-Cresta (1962) 2 developments *33-yr license issued 10/24/01*	North Fork Feather River, CA	196.0	- Provide spawning gravel to cover ~75 ft^2 at Granite Creek (tributary to the N. Fork Feather River between the Project's two developments) and maintain gravel on as-needed basis to be determined by the Ecological Resources Committee (ERC) and USFS	Coarse sediment (gravel)	- Outside	Capital: $183 Annual: $23 Annualized: $40.7 (see Notes)	- No
			- Development of a Drum and Radial Gate Operating Plan (see Notes)		- Within	Capital: $200 Annual: $50 Annualized: $53.3	- Yes (see Notes)

Notes:

- The estimated costs of providing gravel in Granite Creek include costs for other fishery habitat improvement (non-sediment transport mitigation related) measures (i.e., development of 2 spawning channels and removal of a weir).
- The Drum and Radial Gate Operating Plan is to be developed for the purposes of improving sediment recruitment through the riverine reaches below the two Project developments to promote bedload movement through the reservoirs December 1 - March 30. To evaluate the effectiveness of the plan over a 5-year test period (wet or normal years), the licensee is to develop a River Sediment Management Monitoring Plan. If the test program is deemed successful by the ERC and USFS, it shall be implemented for the life of the new license. If deemed unsuccessful, the licensee shall develop a plan for experimental gravel placement (not to exceed a quantity of 200 yd^3) in consultation with the ERC and USFS. If the gravel placement program is deemed successful, then a program of gravel addition not to exceed 100 yd^3 annually shall be implemented for the life of the license.

Project	Location (river and state)	Size (MW)	Description of sediment transport mitigation measure(s)	Type of sediment loss	Within/outside project boundary	Estimated cost ($1,000)	Monitoring requirement
9. Mokelumne River (137) 11 developments (4 hydro; 7 storage) *30-yr license issued 10/11/01*	Mokelumne, North Fork Mokelumne and Bear rivers, CA	215.0	- Breach and remove sediment from diversion structures on East and West Panther Creek and dismantle certain diversion structures on Beaver Creek (all located downstream of most upstream hydro development), actions which are expected to result in the restoration of the N. Fork Mokelumne River to more natural conditions and to, among other things, provide sediment transport (see Notes) - Provide annual pulse flows to the river segments below each of the 4 project hydro facilities consistent with the proposed schedule set forth in the settlement agreement to, among other things, provide for sediment transport (see Notes)	Not specified	- Within (though the location of the diversion dams will be removed from the boundary) - Within	Capital: $275 Annualized: $39.6 Annualized: $1,535.6 (see Notes) Annual cost for SEMP: $500 (see Notes)	Yes (see Notes)

Notes:

- A plan for demolition of the diversion dams is to be prepared within 6 months of license issuance. Demolition shall commence within one year of obtaining required permits and approvals and conclude 2 years thereafter.
- Annual pulse flows to begin within 3 months of license issuance.
- The licensee is to develop a Stream Ecology Monitoring Plan (SEMP) (as part of its adaptive management program) within 3 months of license issuance to determine if the ecological resource objectives set forth in the settlement agreement (Appendix B, Section 1) are being met. Both sediment transport mitigation measures are to be covered by this plan. The initial set of pulse flows are to be monitored for a period of 5 years, followed by two successive 5-year periods of potentially modified regimes.
- The estimated cost of providing annual pulse flows (i.e., generation loss) includes the cost of providing minimum flows as well as pulse flows and is the average of the costs estimated for the initial and maximum flow regimes.
- The estimated cost for the SEMP includes the monitoring of all mitigation measures that are aimed at addressing all ecological resource objectives, not just the pulse flows and diversion dam breaches.

10. Haas-Kings River (1988) 2 developments *40-yr license issued 03/06/01*	North Fork Kings River, CA	193.1	NONE	--	--	--	--
11. Michigamme (1759) 8 projects; 10 dams *40-yr license issued 01/12/01*	Menominee, Paint and Michigamme rivers, WI/MI	61.1	NONE	--	--	--	--

Project	Location (river and state)	Size (MW)	Description of sediment transport mitigation measure(s)	Type of sediment loss	Within/outside project boundary	Estimated cost ($1,000)	Monitoring requirement
12. Missouri-Madison (2188) 9 developments (8 hydro, 1 storage) *40-yr license issued 09/27/00*	Missouri and Madison rivers, MT	326.9	Development of Fisheries Plan (every three years) for implementation of specific mitigation and enhancement measures, which include sediment transport-related conditions, and post-licensing evaluation and monitoring (see Notes)	Gravel and fine sediment	Within	Capital: $20 plus annual O&M: $13.3 (see Notes)	Yes (see Notes)
Notes: - Estimated cost break down: $10,000/year to monitor flushing flow needs, $20,000 one-time to develop the fisheries habitat protection plan (which includes non-sediment transport mitigation related measures), and $3,300/year to prepare a fisheries monitoring plan. - The Fisheries Plan shall include provisions for the initial supplementation of spawning gravel within the Madison bypass reach (most downstream of the two project developments on the Madison River), to monitor the effectiveness of the supplementation effort and based on this evaluation make annual replacements as needed. The plan shall also include a condition for monitoring of flushing flow needs in the lower Madison River that could potentially restore gravel that has become embedded and redistribute gravels as natural high flow events would do.							
13. Curtis-Palmer (2609) 2 developments *40-yr license issued 04/27/00*	Hudson River, NY	58.3	NONE	--	--	--	--
14. Clark Fork River (2058) 2 developments *45-yr license issued 02/23/00*	Clark Fork River, ID/MT	697	NONE	--	--	--	--
15. Cushman (460) 2 developments *40-yr license issued 07/30/98*	N. Fork Skokomish River, WA	131.0	- As part of a fish habitat enhancement and restoration plan to be developed within 180 days of license issuance, a gravel augmentation program in the lower North Fork Skokomish River (below the most downstream of the Project's 2 developments) shall be developed (see Notes) - Periodic 300-cfs flushing flows to remove the fine sediment that has accumulated in the lower river	Cobble/gravel	Within	Capital: $105 Annualized: $9 (see Notes)	Yes (see Notes)
Notes: - The licensee is to describe in the fish habitat enhancement and restoration plan the amount and type of gravel to be used and include provisions for evaluating the need for gravel augmentation in the segment of river from the Lower Falls to McTaggert Creek. - Estimated costs are for all fish and habitat enhancement measures – there are no estimates for individual measures. - A component of the fish habitat and population monitoring plan shall be a description of proposed methods for, among other things, monitoring sediment transport. The plan shall be developed and revised every five years. The plan shall include a schedule for its implementation.							

Project	Location (river and state)	Size (MW)	Description of sediment transport mitigation measure(s)	Type of sediment loss	Within/outside project boundary	Estimated cost ($1,000)	Monitoring requirement
16. Kingsley (1417) 29 dams (4 hydro) *40-yr license issued 07/29/98*	N. Platte and Platte rivers, NE	105.9	NONE	--	--	--	--
17. Wyman (2329) 1 development *40-yr license issued 11/25/97*	Kennebec River, ME	72.0	NONE	--	--	--	--
18. Deerfield (2323) 8 developments (7 hydro; 1 storage) *40-yr license issued 04/04/97*	Deerfield River, VT/MA	76.9	NONE	--	--	--	--
19. Nisqually River (1862) 2 developments *40-yr license issued 03/07/97*	Nisqually River, WA	115.0	- Prepare a plan within 6 months of license issuance to conduct a gravel augmentation study (of no more than 1,000 yd^3) between La Grande Powerhouse (most downstream of Project's 2 developments) and the Mashel River (see Notes) - Prepare a plan within 6 months of license issuance for a gravel augmentation program in the La Grande bypass reach (see details on gravel augmentation study plan below for content requirements of the bypass reach program plan)	Gravel / fine sediment	Within	Capital: $31 O&M: $17.8 (assuming long-term implementation) Capital: $31 O&M: $17.8 (assuming long-term implementation)	Yes (see Notes)
Notes: The gravel augmentation study plan shall include a schedule for the implementation and evaluation of the program's effectiveness in improving salmonid spawning downstream of La Grande Powerhouse. If after 5 years of assessment the study results indicate that gravel availability is limited in the reach from La Grande Powerhouse to the Mashel River or that spawning habitat is enhanced by gravel augmentation, the licensee shall prepare a plan for gravel augmentation that will include 1) a description of objectives, including measurable criteria for evaluation; 2) a map showing the location(s) of proposed gravel placements; 3) estimates of the amount of gravel needed initially for restoration and for addition at subsequent intervals for site maintenance; 4) a description of the parameters that will be measured to determine the value of gravel placements to anadromous fish reproduction; and 5) measures used to determine the stability and life expectancy of such placements.							
20. Penobscot Mills (2458) 5 developments (4 hydro; 1 storage) *30-yr license issued 10/22/96*	Penobscot River and Millinocket Creek, ME	70.6	NONE	--	--	--	--
21. North Georgia (2354) 6 developments *40-yr license issued 10/03/96*	Tallulah, Chattooga, and Tugalo rivers, SC/GA	166.4	NONE	--	--	--	--

Project	Location (river and state)	Size (MW)	Description of sediment transport mitigation measure(s)	Type of sediment loss	Within/outside project boundary	Estimated cost ($1,000)	Monitoring requirement
22. St. Louis River (2360) 9 developments (4 hydro (35 dams); 5 storage) *40-yr license issued 07/13/95*	St. Louis, Whiteface, and Cloquet rivers, MN	88.6	NONE	--	--	--	--
23. Skagit River (553) 3 developments *30-yr license issued 05/16/95*	Skagit River, WA	689.4	NONE	--	--	--	--
24. Lynn Lake (2459) 1 development *30-yr license issued 12/27/94*	Cheat River, WV/PA	51.2	NONE	--	--	--	--
25. Walters (432) 1 development *40-yr license issued 11/04/94*	Pigeon River, NC	108	NONE	--	--	--	--
26. Foote (2436) + 10 projects 11 projects; 11 developments *40-yr license(s) issued 07/15/94*	Muskegon, Manistee, and Au Sable rivers, MI	123.7	NONE	--	--	--	--

Project	Location (river and state)	Size (MW)	Description of sediment transport mitigation measure(s)	Type of sediment loss	Within/outside project boundary	Estimated cost ($1,000)	Monitoring requirement
27. North Umpqua (1927) 8 developments *New license not issued to date; current license expired 01/29/97*	North Umpqua River, OR	185.5	- Continue with ongoing gravel augmentation program (400 yd^3/year) in the bypass reach below Soda Springs (most downstream of the Project's 8 developments) until completion of the Soda Springs Bypass Reach Alluvial Restoration Project plan (see Notes) - Provide passage of sediment past Slide Creek Dam (second to last downstream development) using existing facilities (i.e., opening flood gates during high flow) in coordination with other restoration projects occurring in the same area	Gravel / fine sediment	Within	Annual O&M: up to $5 for continued gravel augmentation until Alluvial Restoration Project commences Costs for two restoration projects - Capital: $6,793 O&M: $92 Annualized: $1,013 (see Notes)	Yes (see Notes)
Notes: - FERC has yet to issue a new license for this project but the above-outlined sediment transport mitigation measures were set forth in the FERC Staff's NEPA document and reflect its recommendation(s). - The licensee is to provide gravel augmentation in coordination with the Soda Springs Bypass Reach Alluvial Restoration Project and after consultation with specified agencies regarding quantity, quality, and timing of the gravel augmentation. Upon issuance of the license, the licensee shall commence preparing a study plan for the Soda Springs Bypass Reach Alluvial Restoration Project. Approximately 5,000 to 15,000 ft^2 of spawning habitat in the Soda Springs bypass reach is to be created in this area. - The licensee is to prepare plans for implementation, monitoring, and evaluation of the Slide Creek Bypass Reach Habitat Enhancement Project (which includes the sediment passage measure mentioned above) and the Soda Springs Bypass Reach Alluvial Restoration Project. The licensee shall also conduct a baseline habitat survey of current spawning habitat under existing flow and channel conditions in both areas upon issuance of the license in order to evaluate the success of the respective restoration measures once they are implemented. - The estimated costs for the Soda Springs and Slide Creek habitat restoration/enhancement projects include all costs associated with geology and soils PM&Es. Individual estimates by measure were not available.							
28. Mid-Snake River: Bliss (1975), Lower Salmon Falls (2061), Upper Salmon Falls (2777), Shoshone Falls (2778) 4 developments *New license not issued to date; current license(s) expired 12/31/97, 02/28/98 and 05/31/99*	Snake River, ID	182.0	Provide spring flushing flows to cleanse substrates and recruit gravels (see Notes)	Spawning gravel	Within	Not provided	None specified
Notes: FERC has yet to issue a new license for this project, but according to the FERC FEIS, American Rivers and Idaho Rivers United recommended the measure outlined above. In its FEIS, the FERC Staff did not make a recommendation on any issues, rather it provided a comparison of proposed actions and alternatives; however, it did state that although current trout habitat conditions downstream of the Project appear to be gravel-limited and poor due to fine sediment deposition, because of the limited storage capacity of the Project, it is not able to release flows large enough to cleanse the substrate of fine sediments as recommended by the NGOs.							

Project	Location (river and state)	Size (MW)	Description of sediment transport mitigation measure(s)	Type of sediment loss	Within/outside project boundary	Estimated cost ($1,000)	Monitoring requirement
29. Big Creek 4 (2017) 1 development *New license not issued to date; current license expired 02/28/99*	San Joaquin River, CA	98.8	NONE (see Notes)	--	--	--	--
Notes: FERC has yet to issue a new license for this project, but according to FERC's FEIS, there are no sediment transport mitigation measures proposed, recommended or mandated for this Project.							
30. C.J. Strike (2055) 1 development *New license not issued to date; current license expired 11/30/00*	Snake and Bruneau rivers, ID	82.8	NONE (see Notes)	--	--	--	--
Notes: FERC has yet to issue a new license for this project, but according to FERC's FEIS, there are no sediment transport mitigation measures proposed, recommended or mandated for this Project.							
31. Roanoke Rapids-Gaston (2009) 2 developments *New license not issued to date; current license expired 01/31/01*	Roanoke River, NC/VA	278.0	NONE (see Notes)	--	--	--	--
Notes: FERC has yet to issue a new license for this project, but according to the proposed Settlement Agreement, there are no sediment transport mitigation measures proposed, recommended or mandated for this Project.							
32. Bear River: Soda (20), Oneida (472), Grace/Cove (2401) 3 projects; 4 developments *New license(s) not issued to date; current license(s) expired 10/01/01*	Bear River, ID	84.5	NONE (see Notes)	--	--	--	--
Notes: FERC has yet to issue a new license for this project, but according to FERC's FEIS, there are no sediment transport mitigation measures proposed, recommended or mandated for this Project.							
33. Box Canyon (2042) 1 development *New license not issued to date; current license expired 01/31/02*	Pend Oreille River, ID/WA	60.0	NONE (see Notes)	--	--	--	--
Notes: FERC has yet to issue a new license for this project, but according to FERC's DEIS, there are no sediment transport mitigation measures proposed, recommended or mandated for this Project.							

Project	Location (river and state)	Size (MW)	Description of sediment transport mitigation measure(s)	Type of sediment loss	Within/outside project boundary	Estimated cost ($1,000)	Monitoring requirement
34. Pit No. 3, 4, 5 (233) 3 developments; 4 dams *New license not issued to date; current license expires 10/31/03*	Pit River, CA	325.0	Gravel augmentation program in upper portions of the Pit 3 and 4 bypass reaches (most upstream of the Project's 3 developments) to be developed in consultation with resource agencies (see Notes)	Spawning gravel	Within	Not available (see Notes)	Yes (see Notes)
Notes: - FERC has yet to issue a new license for this project, but according to FERC's DEIS, the FERC Staff has made the recommendation for a gravel augmentation program outlined above. Though the FERC Staff does not specify a quantity of gravel to be placed in the designated areas, it states that a limited amount of gravel (approximately 2 to 5 tons annually) could provide enough substrate to substantially enhance trout reproduction without risking major losses of trout refuge habitat or other unintended effects on habitat conditions for sensitive fish or mollusk species. - Cost estimates are in Part 2 of the DEIS that is not available through FERC's e-library for public viewing due to a "Non-Public" classification. - As part of the program, FERC recommends at least 4 years of monitoring of trout populations or spawning surveys prior to implementation and monitoring at 4-year intervals after implementation to evaluate and quantify benefits to trout reproduction, recruitment, and population size.							
35. St. Lawrence – FDR (2000) 4 developments *New license not issued to date; current license expires 10/31/03*	St. Lawrence River, NY	912.0	NONE (see Notes)	--	--	--	--
Notes: FERC has yet to issue a new license for this project, but according to FERC's DEIS, there are no sediment transport mitigation measures proposed, recommended or mandated for this Project.							

Notes:

1 Projects that have yet to be issued a new license since undergoing relicensing as early as 1994, for which FERC has issued a NEPA document (DEA/DEIS or FEA/FEIS) and/or the relicensing participants have filed a settlement agreement, have been included in the summary for a more comprehensive review.